7th Annual NASA TOLNet and Pandora Project Science Team Workshop
Hosted Virtually from June 2-4th, 2020

Overall meeting objective: To mutually emphasize how TOLNet and Pandora are prepared to both evaluate and complement geostationary platforms such as TEMPO, GEMS, and Sentinel-4. This objective can be allocated to five main themes:

- *Integration of Ground-based networks* (TOLNet, Pandora, EPA nets, MPLNet, AERONet, FAA ceilometers, etc.) with space-borne assets (TEMPO, MAIA, GOES, TROPOMI, etc.) for Comprehensive Air-quality Observation.
- *Direct Satellite and Model Validation/Evaluation (historically and in the age of GEO, including GEMS to prepare for TEMPO)*
- *Continuous, Long-term, Air-Quality Measurements*
- *Field Campaigns Sponsored by and Focused on User's Needs* (e.g., OWLETS, LISTOS, LVOS, LMOS, etc.)
- *Research and Analyses (Process Studies) of extensive observations and Field Campaigns*

Whitepaper Document to be Outlined During/After Meeting

Summary of Key Community Discussions:

1. *Integration of Ground-based networks (TOLNet, Pandora, EPA nets, MPLnet, Aeronet, FAA ceilometers, etc.) with space-borne assets (TEMPO, MAIA, GOES, TROPOMI, etc.) for Comprehensive Air-quality Observation.*
2. *Validation/Siting Priorities for TEMPO*
3. *Science Priorities, eventual field activities associated with priorities*
4. *AQ/Regulatory priorities, and how do we ensure stakeholders are ready for TEMPO*
5. *What is the "ideal" TEMPO validation platform and what temporal frequency of observations are needed?*
    a. *In situ: NO_2, O_3, HCHO, VOC, Surface met*
    b. *Profilers: TOLNet Lidar, ceilometer, sonde, light aircraft.*
    c. *Passive: Pandora Columnar Products (and possibly profiles)*
6. *Data dissemination and how to rapidly get data to the communities/stakeholders.*

Rapporteurs are charged with the important task of objectively recording the proceedings and collaborative presentations. Throughout the conference, a diverse team of rapporteurs will report on key conference highlights across all tracks and community activities. These summaries will be presented at the closing session of each day. This session synthesizes the presentations made during the week, focusing on critical issues addressed, important results presented and key recommendations put forward.

Rapporteur Team: Alexander Kotsakis (NASA GSFC), Fernando Santos (NASA GSFC), Bo Wang (UAH), Liqiao Lei (NASA LaRC), and Claudia Bernier (U. Houston).

Tuesday, June 2, 2020 (All times in EDT)

10:30	10:40	Welcome	Pat McCormick
10:40	11:00	TOLNet Kick Off Introduction	Barry Lefer, Mike Newchurch, John Sullivan
11:00	12:00	10 min/5 Slides: TOLNet Station Updates (Hampton, LaRC, GSFC, CCNY, ECCC)	Jia Su, Timothy Berkoff, Sullivan, Fred Moshary, Kevin Strawbridge
11:50	**12:00**	**Discussion/Buffer/Short Break**	
12:00	12:30	10 min/5 Slides Each: TOLNet Station Updates (UAH, NOAA, JPL/TMF,)	Thierry Leblanc, Christoph Senff, Shi Kuang
12:30	13:00	NASA Ames Update (w/ Pandora Update) and Alert Discussion	Matthew Johnson
13:00	**13:40**	**Meal Break**	
13:40	14:30	Data LaRC Update, Website Framework Walkthrough, Discussion on Future Steps	Michael Shook, Crystal Gummo, Gao Chen
14:30	**14:40**	**Discussion/Buffer/Short Break**	
14:40	14:55	Aerosol optical properties (330-800nm) retrieved from extended-Pandora (SMART-s)	Ukkyo Jeong
14:55	15:10	Ozone Lidar Evaluation of GEOS-CF during Stratospheric Intrusion over VA	Guillaume Gronoff
15:10	15:25	Preliminary Investigation of Ozone and Aerosol transport from Wildfire Emission Events During the LISTOS Campaign	Liqiao Lei
15:25	**15:35**	**Discussion/Buffer/Short Break**	
15:35	15:50	Case study of ozone diurnal variation in the CBL using ozone Lidar and LES	Guanyu Huang
15:50	16:05	Synthesis analysis of multi-dimensional ozone measurements in coastal environments toward improving ozone simulations	Claudia Bernier
16:05	16:20	Assessment of Los Angeles basin pollution impact in the near-ground ozone concentration at Table Mountain Facility	Fernando Chouza
16:20	**16:30**	**Discussion/Buffer/Short Break**	
16:30	17:00	SBIR Update - Continued Efforts towards Commercial UV Transmitter	Bridger Photonics, Inc. Grant Aivazian
17:00	17:30	Future Hardware Discussion (Automation, Scanning, etc.)	Fernando Chouza, Raul Alvarez
17:30	18:30	**Remaining Discussions/Time Buffer/Summary from Rapporteurs**	

Wednesday, June 3, 2020 (All times in EDT)

10:30	10:45	TOLNet/Pandora/TEMPO Synergies and Guidance of Future Direction	Jack Kaye
10:45	11:00	State of the Science of Existing Air-quality Satellites in the Framework of the Geostationary Era: Where do we want to go and how do the ground-based networks help?	Kelly Chance
11:00	11:20	Initial GEMS Accomplishments: First Geostationary Air-quality Instrument. What do the ground-based assets contribute?	Jhoon Kim
11:20	11:40	What is the value of ground-based Instruments to the European Space-borne Air-quality Missions?	Pieternel Levelt
11:40	12:00	How do Ground-based Assets Contribute to the NOAA Space-borne Air-Quality Missions (Context and Ozone Precursors/Aerosol)?	Shobha Kondragunta
12:00	**12:10**	**Discussion/Buffer/Short Break**	
12:10	12:35	CEOS Air Quality Constellation Validation Strategy	Jay Al-Saadi
12:35	12:50	MAIA/TEMPO synergies Enhanced by Ground-based Assets	Mike Garay
12:50	13:05	TEMPO Products Enhanced by Ground-based observations	Caroline Nowlan
13:05	13:20	Pandora European Perspective on Ground-based Synergy with Space-Borne Air-Quality Observations	Alexander Cede
13:20	**14:00**	**Meal Break**	
14:00	14:15	Decadal Survey Talk: Relevance to TOLNet and Pandora and Future Linkages	Barry Lefer
14:15	14:30	Discussion on connecting SPARTAN with TOLNet and Pandora and TROPOMI NO2 in preparation for TEMPO	Randall Martin
14:30	14:50	Continued Discussion on Prioritized Needs from Regulatory Community from TOLNet/Pandora looking towards TEMPO • Community identification: What is the ideal TEMPO measurement cal/val platform and how does this feed into measurement platforms • Where should emphasis be placed? More observations, vs continuous observations, vs more sites?	Randall Martin, Rapporteurs
14:50	**15:00**	**Discussion/Buffer/Short Break**	
15:00	15:20	State of The Science Overview of Regulatory Needs in the Framework of the Geostationary Air-quality Era: Where are we now and where do we want to go?	Luke Valin/Jim Szykman
15:20	15:35	Regulatory Observations and Data Gaps in Air Quality	Tom Moore
15:35	15:50	Mexico Perspective on Ground-based Synergy with Space-Borne Air-Quality Observations	Michel Grutter

15:50	**16:00**	**Discussion/Buffer/Short Break**	
16:00	16:15	ECCC Perspective on Ground-based Synergy with Space-Borne Air-Quality Observations	Chris Mclinden
16:15	16:25	Pandora-TROPOMI validation work in the Toronto area	Xiaoyi Zhao
16:25	16:35	Canadian Pandora program updates	Jonathan Davies
16:35	**16:45**	**Discussion/Buffer/Short Break**	
16:45	17:00	MPLNet Synergy with TOLNet, Pandora, other Ground-based networks and Space-borne Air-quality Observations.	Judd Welton
17:00	17:15	Ceilometer/EPAMS Synergy with TOLNet, Pandora, other Ground-based networks and Space-borne Air-quality Observations.	Ruben Delgado
17:15	17:30	Ozonesondes: Reference Instrument for TOLNet and Pandora Ozone Measurements	Anne Thompson
17:30	**17:40**	**Discussion/Buffer/Short Break**	
17:40	18:30	Continued Discussion on the Diversity of Prioritized Needs from Regulatory Community from TOLNet/Pandora looking towards TEMPO (With emphasis on joint EPA and other ground network management in attendance) • Connecting Back to Regionally Specific Needs and How that Feeds back to TEMPO efforts	(5 mins each, moderated by EPA) /Tom Moore/Jay Olaguer, Paul Miller/ Kirk Baker
18:30	18:45	Pandora Network Across Asia	Limseok Chang
18:45	19:30	Wrap Up/Summary from Rapporteurs on Prioritized Needs from Regulatory Community from TOLNet/Pandora looking towards TEMPO	

Thursday, June 4, 2020 (All times in EDT)

10:30	10:40	Welcome/Introduction	Tom Hanisco/Bob Swap
10:40	11:00	State of the Science Overview of Modeling/CTM in the Framework of the Geostationary Era (Where are we now and where do we want to go)	Brad Pierce
11:00	11:15	Overview of the GEOS-CF, applications and evaluations using TOLNet and Pandora observations	Emma Knowland
11:15	11:30	GEOS-CF model evaluation using TOLNet ozone data	Matthew Johnson
11:30	11:45	The role of satellite data in estimating air pollution emissions, exposures, and public health impacts in cities worldwide	Dan Goldberg
11:45	12:00	What can we/have we learned from Synthetic Data	Aaron Naeger
12:00	**12:10**	**Discussion/Buffer/Short Break**	
12:10	12:40	Community Discussion: What the CTM community needs from TOLNet/Pandora to better evaluate • the CTM that will ultimately feed the TEMPO a-prior • CTM with desired observables and sites (stay home vs. campaigns)	Matthew Johnson, Emma Knowland, Rapporteurs
12:40	**13:20**	**Meal Break**	
13:20	13:40	Evaluating Pandora with multi-perspective observations during field campaigns: surface, profile, and column comparisons	Jim Crawford
13:40	13:55	An Overview of the 2017 Fires, Asian, and Stratospheric Transport -Las Vegas Ozone Study (*FAST*-LVOS)	Andrew Langford
13:55	14:10	OWLETS-2: Direct Observations of Pollution Gradients Within the Chesapeake Bay	John Sullivan
14:10	14:25	Early results and new insights from an intra-urban deployment of Pandora spectrometers in a coastal urban environment	Jeff Geddes
14:25	**15:35**	**Discussion/Buffer/Short Break**	
14:35	14:45	MAX-DOAS HCHO Retrievals	Bill Simpson
14:45	14:55	ALPACA – Vertical Profiling Results	Jingqiu Mao
14:55	15:10	Ship-Based Pandora Emissions Monitoring	Maria Tzortziou
15:10	15:25	GeoTASO/GCAS Observations and Analyses from Field Campaigns	Laura Judd
15:25	**15:35**	**Discussion/Buffer/Short Break**	
15:35	16:00	Urban air pollution monitoring at micro, local and mesoscales using Pandora instruments (including examples from BWI, ATL airports)	Elena Lind, Jen Kaiser
16:00	16:15	SCOAPE Pandora/Cruise Comparisons and Analyses	Debra Kollonige
16:15	16:30	Pandora Boulder	Irina Petropavlovskikh
16:30	**16:40**	**Discussion/Buffer/Short Break**	
16:40	17:30	Community Discussion w/ Field Knowledge from Previous Talks: Network Direction and Future Campaign Plans in 2021 and Beyond • 2021 Campaigns: NOAA AERROMA, MOOSE, DOE TRACER/TRACER-AQ • 2023 and Beyond: Future activities (US and international) • Community Input on other sites moving towards TEMPO • Strengths, Weaknesses, Connecting to Previous Day	John Sullivan, Tom Hanisco, Mike Newchurch, Bob Swap, Rapporteurs